Applicants:	Samuel Barran Tafoya and Hans G. Broemel
Serial Number:	10/700,027
Date Filed:	November 3, 2003
Title:	Marine Reaction Thruster
Examiner:	Sherman D. Basinger
Group Art Unit:	3617

Listing of All Claims with Identification of Current Status
[with additions underlined and canceled language having strike-through markings]

1. (Currently Amended) A marine reaction thruster for use within a marine hull, said thruster comprising:

an elongated housing having a cross-sectional configuration and opposing ends, a drive shaft opening through one of said opposing ends and a discharge opening through the other of said opposing ends, a wide end adjacent to said drive shaft opening, a bottom fluid inlet opening in said wide end, an upper opening, a tapering central portion between said inlet opening and said upper opening, and a tapering narrow end between said upper opening and said discharge opening;

a drive shaft extending longitudinally through said housing between said drive shaft opening and said narrow end of said housing, said drive shaft having a distal end;

a plurality of propellers having different diameter dimensions, each of said propellers being supported by said drive shaft and positioned for rotation within said tapering central portion of said housing, with the largest one of said propellers being adjacent to said inlet opening and the remainder of said propellers being positioned according to decreasing size between said largest propeller and said upper opening, said diameter dimensions of said propellers being selected to substantially fill said cross-sectional configuration of said housing;

inflow inducing means adapted for causing a large volume of fluid to flow through said inlet opening of said housing and into said wide end of said housing; ~~and~~

at least one debris cutter supported by said drive shaft for rotation and said at least one debris cutter being positioned relative to said propellers so that debris in seawater entering said bottom fluid inlet opening of said housing is ground into smaller pieces before it has an opportunity to slow rotation of said propellers; and

strut means associated with said upper opening in said housing and adapted for securing said distal end of said drive shaft so that the velocity of fluid moving across each successive one of said propellers is increased ~~for a total thrust reaction in fluid exiting said discharge opening of at least approximately twenty percent more than conventional propulsion systems of comparable size~~.

2. (Currently Amended) The thruster of claim 1 wherein said propellers are each positioned on said shaft at a ~~maximum~~ pitch angle of between approximately 10^{o} ~~to~~and 12^{o} ~~for elimination of outgassing and cavitation~~.

3. (original) The thruster of claim 1 wherein said fluid inflow means comprises an inlet plate having a keyhole-shaped opening with a smaller end that is positioned in the direction of forward movement of the marine hull to which it is attached, said keyhole-shaped opening being aligned with said inlet opening in said housing, and recessed fastener openings, said keyhole-shaped opening having a wider end and being configured with outside edges designed to cause eddys to form and seawater to flow therethrough at the center portion of said outside edges.

4. (original) The thruster of claim 3 wherein said inlet plate further comprises a plurality of recessed fastener openings for flush mounting within a marine hull.

5. (original) The thruster of claim 1 further comprising a front casting connected to the one of said opposing ends of said housing having a drive shaft opening.

6. (original) The thruster of claim 1 further comprising a reverse and steering assembly aligned with the one of said opposing ends of said housing having said discharge opening, and wherein said reverse and steering assembly comprises rudders and a movable gate selectively positioned to block rearward flow of fluid exiting said discharge opening of said housing and traveling through said reverse and steering assembly.

7. (original) The thruster of claim 6 wherein said rudders are connected by a tie bar and have Ackerman geometry that allows one to move more than the other and vice versa.

8. (original) The thruster of claim 6 wherein said rudders have a crescent-shaped configuration.

9. (Currently Amended) The thruster of claim 1 wherein said at least one debris cutter further ~~comprising~~ comprises a debris cutter ~~supported by said drive shaft for rotation and cutting in the direction of rotation, with said debris cutter~~ being positioned adjacent to and forward of all said propellers.

10. (Currently Amended) The thruster of claim 1 ~~9~~ wherein each said propeller has a hub, and further comprising at least one additional debris cutter supported by said drive shaft for rotation and cutting in the direction of rotation, with said at least one additional debris cutter being selected from a group consisting of cutters positioned at one of said hubs and forward of the next adjacent one of said propellers and cutters positioned forward of said strut.

11. (original) A marine reaction thruster for use within a marine hull, said thruster comprising:

an elongated housing having a cross-sectional configuration and opposing ends, a drive shaft opening through one of said opposing ends and a discharge opening through the other of said opposing ends, a wide end adjacent to said drive shaft opening, a bottom water inlet opening in said wide end, an upper opening, a tapering central portion between said inlet opening and said upper opening, and a tapering narrow end between said upper opening and said discharge opening;

a drive shaft extending longitudinally between said drive shaft opening and said narrow end of said housing, said drive shaft having a distal end;

a plurality of propellers having different diameter dimensions, each of said propellers being supported by said drive shaft and positioned for rotation within said tapering central portion of said housing, with the largest one of said propellers being adjacent to said inlet opening and the remainder of said propellers being positioned according to decreasing size between said largest propeller and said upper opening, said diameter dimensions of said propellers being selected to substantially fill said cross-sectional configuration of said housing, and further wherein said propellers are each positioned on said drive shaft at a maximum pitch angle of 10^{o} to 12^{o} to eliminate outgassing and cavitation;

an inlet plate having a keyhole-shaped opening with a smaller end that is positioned in the direction of forward movement of the marine hull to which it is attached, said keyhole-shaped opening being aligned with said inlet opening in said housing, and recessed fastener openings, said keyhole-shaped opening having a wider end at rear and being configured with outside edges that widen from the smaller end causing eddys to form and seawater to flow therethrough at the center portion of said outside edges; and

strut means associated with said upper opening in said housing and adapted for securing said distal end of said drive shaft so that the velocity of fluid moving across each successive one of said propellers is increased for a total thrust reaction in fluid exiting said discharge opening of at least twenty percent.

12. (original) The thruster of claim 11 wherein said strut means comprises a strut plate configured for connection to said housing over said upper opening and a strut downwardly depending from said strut plate into said housing.

13. (Currently Amended) The thruster of claim 11 further comprising a reverse and steering assembly aligned with the one of said opposing ends of said housing having said discharge opening for fluid communication therebetween, and wherein said reverse and steering assembly comprises two crescent-shaped rudders with Ackerman geometry and a gate movable between a position that allows rearward flow of fluid from said reverse and steering assembly and a position whereby said rearward flow of fluid from said reverse and steering assembly is blocked[[[.]]]

14. (original) The thruster of claim 11 wherein said rudders are connected by a tie bar and have Ackerman geometry that allows one to move more than the other in a selected turn and vice versa, while not creating drag or turbulence when in a steering mode.

15. (Currently Amended) The thruster of claim 11 further comprising at least one debris cutter supported by said drive shaft for rotation, with said at least one ~~additional~~ debris cutter being positioned relative to said propellers so that debris in seawater entering said inlet opening is ground into smaller pieces before it has an opportunity to slow rotation of said propellers.

16. (Currently Amended) A method of manufacturing a marine reaction thruster for a marine vessel having an engine and a hull, ~~which causes a total thrust reaction for the marine~~

~~vessel of at least twenty percent more that conventional propulsion systems of comparable size,~~ said method comprising the steps of:

providing a marine hull, an elongated housing having a wide end, a narrow end, and a tapering central portion therebetween, a drive shaft, inflow inducing means, strut means, at least one debris cutter, and a plurality of propellers each having a different diameter dimension sized for positioning said propellers within said tapering central portion of said housing at a spaced-apart distance from ~~the other ones of said propellers~~ one another and said diameter dimensions of said propellers also being only slightly smaller than said housing when positioned within its tapering central portion;

creating a bottom fluid inlet opening in said housing adjacent to said wide end;

creating an upper opening in said housing between said central portion and said narrow end;

creating a drive shaft opening in said wide end;

creating a discharge opening in said narrow end;

securing said housing within said marine hull;

positioning said propellers on said drive shaft for rotation at maximum pitch angles of approximately 10^{o} to 12^{o} with pitch increases so as to maintain fluid velocity while increasing the discharge volume for increased thrust ~~and in decreasing order of said diameter dimensions~~;

positioning said at least one debris cutter relative to said propellers so that debris in seawater entering said bottom fluid inlet opening is ground into smaller pieces before it has an opportunity to sloe rotation of said propellers;

extending said drive shaft through said drive shaft opening in said housing so that said propellers are positioned within said tapering central portion of said housing and the largest one of said propellers is adjacent to said inlet opening;

using said strut means in association with said upper opening to secure said drive shaft and said propellers centrally within said tapering central portion of said housing; and

aligning said inflow inducing means with said inlet opening so that a large volume of fluid is caused to flow through said inlet opening of said housing when said marine hull moves in a forwardly direction.

17. (Currently Amended) The method of claim 16 wherein said fluid inflow inducing means comprises an inlet plate having a keyhole-shaped opening with a wider end, a smaller end, and said wider end having outside edges designed to cause eddys to form and seawater to flow into therethrough at the center portion of said outside edges, and further comprising the step of positioning said smaller end in the direction of forward movement of said marine hull, and the step of aligning said keyhole-shaped opening with said inlet opening in said housing.

18. (Currently Amended) The method of claim 16 further comprising a step of providing a reverse and steering assembly thruster having ~~crescent-shaped~~ rudders with Ackerman geometry and a gate movable between a position that allows rearward flow of fluid from said reverse and steering assembly and a position whereby said rearward flow of fluid from said reverse and steering assembly is blocked, and also comprising a step of aligning said reverse and steering assembly with said discharge opening in said housing.

19. (Currently Amended) The method of claim 18 wherein said rudders have a cresent-shaped configuration. ~~16 further comprising the steps of providing at least one debris cutter. supporting said at least one debris cutter on said drive shaft for rotation and cutting in the~~

~~direction of rotation, and positioning said at least one debris cutter relative to said propellers so that debris in seawater entering said inlet opening is ground into smaller pieces before it has an opportunity to slow rotation of said propellers.~~

20. (original) The method of claim 16 wherein said steps of creating, securing, positioning, and aligning are accomplished in a different order.